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Direct Seeded Rice cultivation technology- Acceptance Status in Haryana state of India

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ABSTRACT

Production of conventional puddled transplanted rice is facing severe constraints because of water and labor scarcity and climatic changes. Direct Seeded Rice (DSR) is a feasible alternative with good potential to save water, reduce labor requirement, mitigation of green house gases (GHGs) emission and adaptability to climate risks. Considering its importance, an exploratory study was carried out in Haryana state during 2020-21 with an objective to examine the acceptance of DSR cultivation technology and constraints faced by farmers during its acceptance. Present study was conducted in Haryana during 2020 & 2021, Selecting 2 districts randomly, two blocks were selected randomly, from each selected district, further two villages from each selected block and then twenty farmers from each selected village were selected at random. Thus, a total of 160 farmers were selected for the study. The primary data were obtained through personal interview method using a structured interview schedule. Findings of the study revealed that majority of the farmers belonged to middle age group having medium size of farm, educated up to secondary school, medium category of mass media exposure, economic motivation, most of them, i.e. 88.20 per cent belonged to Low to Medium category of The overall adoption of DSR cultivation. However, very serious constraints in acceptance of DSR technology were viz., infestation of weeds, inadequate knowledge of DSR, occurrence of rain before germination, unwillingness to change and non-availability of DSR machine at the time of sowing, etc. The correlation and regression of different variables, i.e. education, land holding, availability of farm equipments, mass media exposure, extension contact, economic motivation, risk orientation and innovativeness exhibited positive and significant correlation with adoption level of DSR technology at 0.05 level of probability.

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1. INTRODUCTION

Rice (*Oryza sativa* L.) is the staple food for more than half of the world population. Asia accounts for 90 per cent of the world's total rice area and production. In India, rice is grown on approximately 47 million ha annually with a production of 120 million tons (MT) [2]. Whereas, the crop demand is estimated to rise to 145 MT in 2033, which is equivalent to an overall increase of 22% in the next 10 years [1]. But, the current studies shows declining factor productivity and a plateau in rice yields due to fatigued natural resources, declining water table, increasing labour scarcity and energy shortage, escalating fuel prices and changing climatic conditions. Therefore, yield gains have to be achieved by using less water, labour, land, and energy. Considering these factors, only Direct Seeded Rice (DSR) is a feasible alternative with good potential to save water, reduce labour requirement, mitigation of green house gases (GHGs) emission and adaptability to climate risks [9].

In Direct Seeded Rice (DSR), seeds are sown before or immediately after pre-monsoon rain. Transplanting method of rice cultivation involves three basic operations, namely, puddling (a process where soil is compacted to reduce water seepage), transplanting and maintaining standing water. These three operations can be avoided with the adoption of DSR [9]. Direct seeding is of two types (1) Wet-DSR, in which, on puddled soil, sprouted rice seeds are broadcast or sown in lines and (2) Dry-DSR, in which, after dry tillage or zero tillage, dry rice seeds are drilled or broadcast on unpuddled soil.

Haryana is the second largest state to contribute in central procurement pool of rice after Punjab and plays a key role in the agricultural transformation of the country [8]. In the state, rice is generally grown in 18 districts. Out of that, seven districts are in high productivity group, that is, yield more than 2,500 kg/ha, involving high amount of water use for land preparation and the growing period, which results in adverse effects on water table. Therefore, there is an urgent need to shift from traditional transplanting method of rice cultivation to DSR, as it tends to reduce water consumption, labour requirement and helps to maintain the soil structure. However, the recent methods of paddy cultivation *i.e* direct seeded rice in Haryana is limited to the few paddy growing districts and only with the assistance of the Department of Agriculture, Haryana. In this backdrop, the survey study was carried out with an objective to examine the adoption of DSR cultivation technology practices recommended by CCS Haryana Agricultural University, Hisar and constraints faced by farmers during its adoption.

2. MATERIALS AND METHODS

2.1 Research Design and Collection of Data

Study was conducted in Haryana state of the country during 2020-21. From the state, two districts viz., Ambala and Kurukshetra were selected purposively because maximum cultivation of rice is under two districts. From each district, two blocks were selected randomly viz., Narayangarh and Ambala-I, from Ambala and Shahabad & Ismailabad from Kurukshetra district. Further, two villages were selected randomly from each selected block. Thus, eight villages, namely, Gadouli and Ganouli from Naryangarh block and Balana and Anandpur Jalbera from Ambala-I block from Ambala and Raipur and Rai Majara from Shahabad block; Thol and Mandheri from Ismailabad block from Kurukshetra were selected randomly. Further, twenty farmers were selected, randomly from each selected village. Thus, a total number of 160 farmers were interviewed for the present study. To collect the primary data, ex-post facto research design was followed whereby respondents were selected with multistage sampling. Farmers were interviewed face

to face using well-structured and pre-tested interview schedule especially prepared for this purpose.

2.2 Measurement of Variables

In order to measure the adoption level, the farmers' responses were recorded in the 3 point continuum scale viz. fully adopted, partially adopted and no adoption for 17 statements and score were given as 3, 2 and 1 respectively. Overall adoption level was determined and the respondents were categorized as low (Up to 28), medium (29-38), high (> 38) on the basis of equidistant method of computing categories. Whereas, in case of constraints, 09 statements were taken and the responses of farmers were obtained on three-point continuum scale as 'very serious', 'serious' and 'not so serious' and weightage was given as 3, 2 and 1, respectively.

2.3 Analysis of Data

Empirical data were tabulated and analyzed using 26th version of Statistical Package for Social Sciences (SPSS) for computing frequency, percentage and mean. Coefficient of correlation and multiple regression analysis was computed to find out the relationship between each independent variables and dependent variable. They provide an overall idea about the influence of different personal variables on farmers' adoption of DSR cultivation technology.

3. RESULTS AND DISCUSSION

Results of the study are presented and discussed under broad headings as socio-personal attributes profile of DSR famers, adoption and constraints faced in adoption of DSR technology and correlation between respondent's personality traits with their adoption level of DSR technology.

3.1 Socio-personal attributes profile of DSR famers

Socio-personal characters of respondents like age, educational qualification, mass media exposure, risk orientation, economic motivation and innovativeness, etc. are likely to influence farmers' attitude towards the adoption of DSR technology (Table 1). Therefore, these parameters were included in the research study and it was found that that most of the farmers (43.20%) belonged to middle age group (43-57 years) having medium size of farm (6-10 acres). In case of education, more than 70 per cent of the respondents (73.20%) had acquired school education *i.e*. middle to higher secondary. Nearly half of the respondents (53.60%) had a medium level of mass media exposure followed by high level (25.10%) and low i.e. 21.30 per cent, respectively. The majority of farmers (47.50%) had medium level of extension contacts, followed by 33.8 and 18.7 per cent low and high level of extension contacts, respectively. With regard to economic motivation, 80 per cent of respondents had a medium to high level of economic drive. In case of risk orientation, 42.0 per cent belonged to medium category of risk orientation, followed by high (33.80 %) and low (24.20%) low level of risk orientation. Approximately 40 per cent respondents (41.30%) belonged to medium level of innovativeness, followed by 32.5 per cent with high level of innovativeness, while 26.2 per cent farmers belonged to low level of innovative proneness category. The findings are in line with those of [6], [11] who revealed that most of the DSR farmers were of the middle age group of 38−50 years, had gained education up to matriculation level and fell in the category of medium (10−25 acres) operational land holdings.

3.2 Farmers' adoption level of DSR technology

Examination of the data presented in Table 2 that practice viz., method of sowing- DSR machine used ranked I with highest weighted mean score (WMS) 2.10, followed by laser leveling and field preparation, ensured suitable soil for direct seeded rice, adjustment for seed depth, suitable timing for field preparation and sowing, calibration of the machine for proper seed rate, DSR in wet/tar-barrar condition, Press wheel

fitted DSR machine used, proper weed management, seed treatment, proper fertilizer used, irrigation as per recommendation, suitable variety, recommended nozzle for spray, sowing time, stopped irrigation about a fortnight before maturity and DSR with inclined plate mechanism ranked II, III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV, XVI, XVII and XVII with WMS 2.09, 2.06, 2.00, 1.93, 1.92, 1.86, 1.81, 1.74, 1.72, 1.71, 1.66, 1.64, 1.55, 1.49 and 0.83, respectively. It reflected that most of the practices are followed as recommended by the CCS Haryana Agricultural University, Hisar, but few practices like seed treatment, proper fertilizer used, recommended nozzle for spray, sowing time, etc. are partially adopted. Hence, there is immense need to motivate and encourage the farmers by organizing continuous trainings, lectures, campaigns and demonstrations. Similar results were observed by [5], [12] who suggested that a lot of awareness needs to be created on the advantages of ploughing, levelling, seed germination, sowing, water and weed management in direct seeding rice using drum seeder in puddle field.

3.3 Overall adoption of DSR technology

From the Table 3 it is apparent that majority of the respondents (64.37%) belonged to low level of adoption category followed by 23.75 per cent medium level and only 11.90 per cent high level of adoption. Further analysis of data reveals that most of the respondents (88.12%) possessed low to medium level of adoption of DSR technology. It seems that farmers had not adopted the full package of practices recommended by CCS HAU, Hisar. It might be due to poor knowledge about DSR technology coupled with long attachments with the conventional method of cultivation. Therefore, the government must aware farmers through reliable mass media like agricultural magazines and literature along with radio & TV programs pertaining to DSR technology, which are essential for supplementing and complementing their knowledge as well as to reach largest number of farmers for its quickest acceptance by the farming community for sustainable food production [7], [10].

3.4 Constraints faced by farmers in adoption of DSR technology

Constraints perceived by farmers in adoption of DSR technology are shown in Table 4 and it reveals that infestation of weeds ranked as I constraint highest weighted mean score (WMS) 2.87, followed by inadequate knowledge of DSR cultivation, occurrence of rain before germination, unwillingness to change, non-availability of DSR machine at the time of sowing, Iron deficiency, gap filling, inappropriate moisture at sowing and depth of seed ranked II, III, IV, V, VI and VII with WMS 2.41, 2.40, 2.36, 2.32, 2.31, 2.17, 1.92 and 1.81, respectively. Similarly, [11] reported that farmers don't have full knowledge of scientific cultivation practices regarding scientific rice cultivation. Therefore, considering the need of more technical knowledge for the adoption of DSR technology, the government should organize training programme for skill development [4], [6].

3.5 Correlation between respondent's personality traits with their adoption level of DSR technology

The correlation and regression coefficient presented in Table 5 show relationship between farmers' personality traits as independent variables and adoption level of DSR technology as dependent variable. Correlation among 12 variables, nine variables i.e. education, land holding, availability of farm equipments, mass media exposure, extension contact, economic motivation, risk orientation and innovativeness exhibited positive and significant correlation at 0.05 level of probability. Similarly, regression coefficient of variables; education, availability of farm equipments, mass media exposure, extension contact, economic motivation and innovativeness exhibited positive and significant effect, however age, land holding, farm power, farming system, training received and risk orientation showed non-significant effect but it was positively correlated with adoption level of DSR technology at 0.05 level of probability. These findings were partially supported by the reports of [4- 6].

Further, it was revealed that all the twelve independent variables included in the study jointly contributed 61.00 per cent variation in adoption level of DSR technology when other factors were kept constant. This means that only 61.00 per cent (r^2=0.61) of the variation in the dependent variable was due to these variables and remaining 39.00 per cent variation was due to extraneous variables.

4. CONCLUSION

The present study concluded that majority of the farmers belonged to middle age group, had gained education up to senior secondary level and fell in the category of medium (6-10 acres) operational land holdings. Most of farmers had medium category of mass media exposure, extension contact, economic motivation, risk orientation and innovativeness. While the practices such as method of sowing, field preparation, ensured suitable soil for direct seeded rice, adjustment for seed depth, suitable timing for field preparation and sowing and calibration of the machine for proper seed rate recommended species were fully adopted by farmers whereas, least adopted practices included, irrigation as per recommendation, suitable variety, recommended nozzle for spray, sowing time and stopped irrigation about a fortnight. It might be due to poor knowledge about DSR technology coupled with long attachments with the conventional method of cultivation. Hence, there is immense need to motivate and encourage the farmers by organizing continuous trainings, lectures, campaigns and demonstrations. Majority of farmers faced constraints like; infestation of weeds, inadequate knowledge of DSR cultivation and non-availability of DSR machine at the time of sowing, etc. A cooperative society with a cluster of villages for ensuring the availability of agri-inputs, DSR machine, at reasonable costs needs to be strengthened. Moreover, a sincere efforts need to given on fine tuning to the low cost integrated weed management technology involving stale seed bed technique, suitable aerobic genotypes, cultural, physical, mechanical and use of low doses of herbicides for different ecosystems in the different regions.

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6. CONFLICT

There is no conflict between author and co-authors

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Table 1. Socio-personal attributes profile of DSR famers (n=160)

Sr. No.	Variables	Category	Frequency	Percentage
1.	Age	Young (up to 42)	67	42.0
		Middle (43-57)	69	43.2
		Old (above 57)	24	15.2
2.	Education	Illiterate	5	3.1
		Primary	10	6.3
		Middle	33	20.6
		Metric	50	31.3
		Higher Secondary	34	21.3
		Graduate and above	28	17.5
3.	Land holding	Less than one acre	1	0.6
		Up to 5 acres	50	31.3
		6 to 10 acres	52	32.5
		11 to 15 acres	18	11.3
		16 to 20 acres	20	12.5
		More than 20 acres	19	11.9
4.	Mass media exposure	Low (up to 12)	34	21.3
		Medium (13-24)	86	53.6
		High (above 24)	40	25.1
5.	Extension contact	Low (up to 5)	54	33.8
		Medium (6-9)	76	47.5
		High (above 9)	30	18.7

6.	Economic motivation	Low (up to 12)	32	20.0
		Medium (13-15)	68	42.5
		High (above 15)	60	37.5
7.	Risk orientation	Low (11-14)	39	24.2
		Medium (15-17)	67	42.0
		High (18-21)	54	33.8
8.	Innovativeness	Low (up to 14)	42	26.2
		Medium (15-18)	66	41.3
		High (above 18)	52	32.5

Table 2: Farmers' adoption level of DSR technology (n=160)

Sr. No.	Practices	Fully adopted	Partially adopted	No adoption	Total weighted score (TWS)	Weighted mean score (WMS)	Rank order
1.	Ensured suitable soil for direct seeded rice	79 (49.37)	12 (7.50)	69 (43.20)	330	2.06	III
2.	Laser leveling and field preparation	82 (51.20)	11 (6.87)	67 (41.87)	335	2.09	II
3.	Method of sowing- DSR machine used	83 (51.90)	10 (6.25)	67 (41.87)	336	2.10	I
4.	Press Wheel fitted DSR machine used	47 (29.40)	35 (21.90)	78 (48.80)	289	1.81	VIII
5.	DSR with inclined plate mechanism	44 (27.50)	38 (23.80)	78 (48.80)	132	0.83	XVII
6.	Adjustment for seed depth and spacing	76 (47.50)	8 (5.00)	76 (47.50)	320	2.00	IV
7.	Suitable timing for field preparation and sowing	65 (40.60)	19 (11.90)	76 (47.50)	309	1.93	V
8.	Suitable variety	26 (16.30)	51 (31.90)	83 (51.90)	263	1.64	XIII
9.	Sowing time	24 (15.00)	40 (25.00)	96 (60.00)	248	1.55	XV
10.	Calibration of the machine for proper seed rate	69 (43.10)	10 (6.30)	81 (50.60)	308	1.92	VI
11.	Seed treatment	42 (26.30)	31 (19.40)	87 (54.40)	275	1.72	X
12.	Proper weed management	39 (24.40)	41 (25.60)	80 (50.00)	279	1.74	IX
13.	Recommended nozzle for spray	31 (19.40)	39 (24.40)	90 (56.30)	261	1.63	XIV
14.	Irrigation as per recommendation	32 (20.00)	41 (25.60)	87 (54.40)	265	1.66	XII
15.	DSR in wet/tar-barrar condition	55 (34.40)	27 (16.90)	78 (48.80)	297	1.86	VII
16.	Stopped irrigation about a fortnight before maturity	10 (6.30)	59 (36.90)	91 (56.90)	239	1.49	XVI
17.	Proper fertilizer used	32 (20.00)	50 (31.30)	78 (48.80)	274	1.71	XI

Table 3. Overall adoption of DSR technology (n=160)

Sr. No.	Category	Adoption score	Frequency	Percentage
1	Low	Up to 28	76	47.50
2	Medium	29-38	50	31.25
3	High	39-48	34	21.25

Table 4: Constraints faced by farmers in adoption of DSR technology (n=160)

Sr. No.	Constraints	Very serious	Serious	Not so serious	TWS	WMS	Rank order
1.	Infestation of weeds	141 (88.12)	17 (10.62)	2 (1.25)	459	2.87	I
2.	Inadequate knowledge of DSR cultivation	78 (48.75)	69 (43.13)	13 (8.12)	385	2.41	II
3.	Occurrence of rain before germination	68 (42.50)	88 (55.00)	4 (2.50)	384	2.40	III
4.	Unwillingness to change	98 (61.25)	22 (13.75)	40 (25.00)	378	2.36	IV
5.	Non-availability of DSR machine at the time of sowing	86 (53.75)	38 (23.75)	36 (22.5)	370	2.32	V
6.	Iron deficiency	101 (63.12)	7 (4.370)	52 (32.50)	369	2.31	VI
7.	Gap filling	56 (35.00)	76 (47.50)	28 (17.50)	348	2.17	VII
8.	Inappropriate moisture at sowing	48 (30.00)	52 (32.50)	60 (37.50)	308	1.92	VIII
9.	Depth of seed	29 (18.12)	71 (44.37)	60 (37.50)	289	1.81	IX

Table 5. Correlation between respondent's personality traits with their adoption level of DSR technology

(n=160)

Sr. No.	Variable	Correlation Coefficient	Regression Coefficient	't' value
1.	Age	-0.124^{NS}	-0.068	0.636^{NS}
2.	Education	0.186*	1.119	2.348*
3.	Land holding	0.213*	0.317	0.361^{NS}
4.	Farm power	0.010^{NS}	1.179	0.556^{NS}
5.	Availability of farm equipments	0.291*	1.177	2.341*
6.	Mass media exposure	0.268*	1.185	2.201*
7.	Faming system	0.182^{NS}	0.528	0.343^{NS}
8.	Extension contact	0.335*	1.114	2.847*
9.	Economic motivation	0.247*	1.116	2.041*
10.	Training received on DSR	0.165*	2.705	1.620^{NS}
11.	Risk orientation	0.261*	0.360	0.396^{NS}
12.	Innovativeness	0.319*	1.290	2.356*

*Significant at P= 0.05 levels NS= Non-significant R^2=0.61